Q/E/TX

Reg. No: 21BIT0197

VIT
Vellore Institute of Technology

Final Assessment Test – May 2024

Course: **BITE403L - Embedded Systems and IoT**

Class NBR(s): **3832** Slot: **F1+TF1**

Time: **Three Hours** Max. Marks: **100**

- **KEEPING MOBILE PHONE/ELECTRONIC DEVICES EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

Answer any TEN Questions

(10 X 10 = 100 Marks)

1. Explain the use of the following registers of 8051 microcontroller with simple assembly language code segments.
   - Accumulator
   - Program status word
   - Scratchpad registers
   - Data pointer

2. With simple examples explain the importance of the following real-time operating system characteristics to run a 'flight control system'.
   - Time constraints
   - Correctness
   - Security
   - Fault tolerance

3. a) Why do we need timers in microcontrollers? Explain with simple examples. **[5]**

   b) How are timer registers organized in 8051 microcontroller? Explain it. **[5]**

4. a) Write an assembly language program for 8051 microcontroller to perform matrix addition (C= A + B) with the following constraints. **[5]**
      - Order of all matrices are 2 x 2.
      - Use scratchpad registers to store the values of A, B, C

   b) With short description and sample values, explain the working of the above assembly language program. **[5]**

5. a) Design an IoT application for 'wild animal tracking' in agriculture lands located near forests with the following components. **[5]**
      - IoT devices
      - Connectivity
      - Cloud deployment
      - User interface

   b) Describe the challenges involved in the given 'wild animal tracking application'. **[5]**

6. Consider an MQTT based 'health band for elderly people', which publishes timestamp, location, and pulse rate of the users to an MQTT broker. Design a simple GUI that uses suitable wildcard-based subscriptions for the care takers to monitor the users. Explain the role of MQTT in the given scenario with a neat diagram.

7. With neat layout diagram, analyse the physical design of the Raspberry Pi 3 model B board. Also, design a simple 'face recognition application' using Raspberry Pi 3 board. Describe the necessary hardware and software components.

8. Assume a temperature sensor is interfaced with an Arduino UNO board. The temperature sensor values will be read only when the Arduino UNO board receives command from a Raspberry Pi board.

   a) With short comments, write a Python code to receive and print the temperature sensor values at Raspberry Pi board. **[5]**

   b) Write the Arduino sketch for the above application. **[5]**

9. With a neat connection diagram and Arduino sketch, explain the working and controlling of a relay switch using Arduino board.

10. Create an IoT based 'Smart Driver Assistance System' with the following features.

    - Obstacle detection and avoidance.
    - Route assistance between source and destination locations.

    a) Identify suitable sensors to meet the given application requirements. Also explain their role & working principle with simple use cases. **[5]**

    b) Draw the layout diagram to show the suitable position of the corresponding sensors and give justification for the same. **[5]**

11. Design an embedded system for "automated removal of waste from ponds". Explain its components and working.

12. Why does a microprocessor prioritize interrupts? How does 8051 microcontroller handle different interrupts? Explain with example.

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